

AU/AWC/RWP191/97-04

AIR WAR COLLEGE

AIR UNIVERSITY

TIME FOR THE U.S. TO RATIFY THE CHEMICAL WEAPONS
CONVENTION—A SUMMARY OF EVENTS AND
ARGUMENTS

by

Robert L. Sutton, Colonel, USAF

A Research Report Submitted to the Faculty

In Partial Fulfillment of the Curriculum Requirements

Advisor: Dr. Barry R. Schneider

Maxwell Air Force Base, Alabama

April 1997

Disclaimer

The views expressed in this academic research paper are those of the author(s) and do not reflect the official policy or position of the US government or the Department of Defense. In accordance with Air Force Instruction 51-303, it is not copyrighted, but is the property of the United States government.

Contents

	<i>Page</i>
DISCLAIMER	ii
LIST OF ILLUSTRATIONS	v
LIST OF TABLES	vi
PREFACE	vii
ABSTRACT	ix
HISTORY	1
Geneva Protocol of 1925.....	1
Wyoming Agreement	3
Bilateral Destruction Agreement of 1990.....	3
Nunn-Lugar Act of 1991	4
Bilateral Chemical and Biological Weapons Agreement of 1992	6
Australia Group	7
CHEMICAL WEAPONS CONVENTION	11
History	11
The Conference of States Parties	12
The Executive Council.....	12
The Technical Secretariat	14
Status.....	14
DEMILITARIZATION	17
Current Technology	17
Alternative Technologies.....	18
Neutralization.....	18
Neutralization followed by Biodegradation	19
Catalytic Extraction Process	19
Electrochemical Oxidation	20
High Temperature Gas Phase Reduction	21
US Status.....	21
Russia Status.....	24
ISSUES	29

Insufficient Construction Rate of Planned Destruction Facilities.....	30
Proliferation of Ballistic Missile Delivery Systems	32
Arguments From Both Perspectives.....	33
Disarms Potential Enemies/Reduces Proliferation/Template for Future Treaties. ...	33
Intelligence Tool Against Adversaries/ Verification is Poor/Cheating is Easy.....	36
Legal Leverage Against Non-membership and Treaty Violators	38
Treaty will Protect U.S. Chemical Trade Industry/Regulates International Trade...	39
Forces Undue Costs on Business/Violates Constitutional Rights of Companies	40
Loss of In-kind Retaliation/Must Maintain Full CW Defense Capability	41
CONCLUSIONS	44
APPENDIX A: SIGNATORIES AND RATIFICATIONS.....	46
APPENDIX B: STATES’ CHEMICAL WEAPON/MISSILE CAPABILITY	51
GLOSSARY	54
BIBLIOGRAPHY	55

Illustrations

	<i>Page</i>
Figure 1. US CW Storage Sites.....	23
Figure 2. Russian CW Storage Sites.....	25

Tables

	<i>Page</i>
Table 1. Members of the Australia Group.....	8
Table 2. OPCW Executive Council Composition.....	13
Table 3. Agent/Weapon Destruction as of 3/24/97	23

Preface

After 27 years of United Nations effort, the Chemical Weapons Convention (CWC) nears reality with the delivery of the 65th ratifying instrument on October 31, 1996. An honor taken by Hungary, not the United States, one of the original nations working toward a ban of chemical weapons since 1968, or by Russia or China. Despite the conspicuous absence of the two, possibly three, largest chemically-armed nations on earth, the treaty will enter into force on April 29, 1997. The first meeting of the treaty's Conference of States Parties (CSP) is scheduled to convene on 6 May 1997.

In the summer of 1996, the CWC ratification effort became mired in US politics as a scheduled Senate vote was postponed until after the presidential election. It was an attempt to prevent the seated president from having the honor of ratification. I was attending the US Air War College at the time and witnessed Hungary become the 65th State Party to ratify the treaty. Failure to be among the first 65 states ratifying the CWC fundamentally eliminated the US from serving on the initial Executive Council of the UN's Organization for the Prevention of Chemical Weapons (OPCW). Failure to ratify the treaty before the first meeting of the CSP prevents the US from serving on the OPCW's Technical Secretariat and associated inspection teams. Failure to ratify it at all could cost the US chemical manufacturers hundreds of million of dollars in trade with CWC members.

On the other hand ratification would result in the complete destruction of the US chemical stockpile. No longer would there be a US and Russia bilateral destruction agreement authorizing a 5,000 ton hedge by each country against non-member states. How would the US respond to a future chemical attack—with advanced conventional weapons or with nuclear weapons, as insinuated by President Bush when faced with an Iraqi chemical attack during Desert Storm? Adopting a specific choice makes many people very uncomfortable.

Sitting in Dr. Barry Schneider's class on weapons of mass destruction and proliferation issues, I pondered those questions and others posed by him. So as the Senate prepares once again to debate and vote on this issue and as Dr. Schneider prepares to host a symposium on weapons of mass destruction in the spring of 1997, I felt compelled to assist those unfamiliar with, but interested in understanding, the issues involved in ratifying or rejecting the treaty. This project provides an abridged history of the various treaties, status of the current US and Russian chemical demilitarization projects, issues at hand, and concludes with recommended actions.

My thanks to Dr. Schneider who served as mentor, editor, and friend as I wormed my way through volumes of books, magazines, news papers and the internet to complete this calling.

Abstract

Chemical weapons are not unique to the modern era. Historical applications are traceable to ancient Greek and Biblical times. However, the wholesale use of chemicals as weapons of mass destruction did not begin until World War I. From that horror in which thousands of unprepared soldiers were killed or maimed, came an international attempt to forever banish the use of such inhumane devices. Unfortunately the resultant 1925 Geneva Protocol only banned first use, not stockpiling, manufacturing, or retaliation use. That failure to regulate weapons through international inspections and include severe penalties for violations allowed state stockpiles to grow beyond excess.

Now the world is on the verge of a new Chemical Weapons Convention (CWC) that not only closes the loopholes of the 1925 Protocol, but promises to truly eliminate a whole class of weapons of mass destruction (WMD) worldwide. Unfortunately the US, Russia, and China had not yet ratified the convention as of March 1997. Under bilateral agreements, the US and Russia have disclosed their stockpiles; however, China's stockpile remains shrouded in secrecy. Russia and China say they await US ratification before delivering their own instruments. Without the ratification signatures of the two, if not the three, largest chemically-armed states on the globe, success of the treaty is unlikely. In addition, the existing bilateral agreements between the US and Russia establish a demilitarization effort to reduce state stockpiles to 5,000 metric tons each. This residual

tonnage serves as a hedge against each other and against those chemically-armed nations not covered under the bilateral agreements or restricted by the CWC.

Failure to ratify the convention could cost the US chemical industry dearly as trade sanctions between CWC members and non-members are incrementally phased in after the treaty enters into force. The magnitude of these sanctions threaten to cost the US \$60 billion in future trade business per year alone. Combined with job and production facility losses, the financial impact would be felt across every economic sector.

By examining the past and present chemical disarmament treaties, and combining the thrust of those agreements with the efforts of concerned authors, experts, and organizations, this project argues that the US must acknowledge its superpower responsibility and ratify the CWC before the first meeting of the CSP in May 1997. In addition, a summary of current and alternate technologies aids in understanding the environmental, political, and safety concerns associated with the global demilitarization of chemical weapons. In order to meet the demilitarization timelines within the CWC, world communities must feel safe and accept these available technologies (in their back yard).

Lastly, a review of critical political, military, and economic issues exposes the arguments for and against ratification. Both sides have valid concerns, and the way we address those concerns, and whether we ratify the convention or not, will be precedent setting.

Chapter 1

History

The threats to our national security did not end with the Cold War. Indeed, during the next dozen years we will live in a world including nations that could kill millions of Americans and destroy our way of life. The CIA estimates that by the year 2000, nine developing countries could have nuclear weapons, up to 30 could have chemical weapons, and 10 could have biological weapons. And what's even more frightening? The CIA usually underestimates the progress being made in the dark corners of the world to produce these weapons. (Remember North Korea and Iraq.)

—Casper Weinberger, Peter Schweizer
The Next War

This statement implies the greatest threat in the proliferation of weapons of mass destruction (WMD), based on the number of states obtaining specific weapon capability, is that of chemical warfare. Note also, that of the three technologies associated with WMDs, chemical technology is the easiest to obtain and manage.¹

Geneva Protocol of 1925

Following the horrors of chemical weaponry experienced in the war to end all wars (WWI), the nations of the world met in Geneva to forever ban the use of such arms. That tool was the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (The Geneva Protocol). Unfortunately, the goal was shortsighted and the desire to forever banish these inhumane

devices failed in the agreement signed in Switzerland in 1925. The Geneva Protocol merely banned the use of chemical weapons and not the production, retaliatory use, or stockpiling. When the United States ratified the Geneva Protocol some 50 years later, it reserved the right to retaliate against states not observing the treaty.²

The most critical shortfall of the Geneva Protocol was the failure to provide a verification process to guarantee that all parties abide by the 1925 Treaty. So as hostilities grew between WWI and WWII, many of the signatory governments changed or ceased to exist. The new governments and those that had not ratified the original agreement did not feel obligated by their predecessor's acts to abide by the treaty. Japan, a non-party to the protocol, actually used chemical weapons against China during WWII.³ As a safeguard against similar acts, the US, also a non-party, amassed a huge chemical weapon arsenal during and after WWII.

In 1968, the US began an effort to ban all state chemical weapons programs in their entirety. That process and the resultant Chemical Weapons Convention (CWC) took 25 years to reach fruition.⁴ In the interim, the US and USSR became the two largest chemically-armed nations on the face of the earth. The US ultimately possessed a stockpile of over 30,000 metric tons of deadly agents loaded in a variety of delivery systems while the USSR stockpile exceeded 40,000 tons.⁵ As the United Nations slowly worked toward completion of the CWC, the US and Russia (the successor state after the fall of the USSR in 1992) worked to a faster schedule. The two superpowers negotiated a series of separate actions and bilateral agreements limiting chemical weapon (CW) arsenals. One of those actions in 1985 was when the US Congress passed Public Law 99-145, directing the Department of Defense to destroy its entire unitary chemical weapon

stockpile by 2004. These unitary weapons represent over 97 percent of the total US chemical stockpile.⁶

Wyoming Agreement

The first bilateral accord between the US and the Soviet Union was the 1989 Memorandum of Agreement, better known as the Wyoming agreement. Just as the Geneva Protocol failed, so too, did the Wyoming agreement. However, it did direct the inventory of state stockpiles (Phase I), and provided for a means of verification through inspections (Phase II).⁷ Phase I proceeded without significant problems. Both sides accused the other of not being completely honest, but nothing hindered what ex post facto appears to have been truthful and accurate disclosures. Phase II was not so simple. With the fall of the USSR, the inspections became mired in the problems of transition. In 1994, Presidents Clinton and Yeltsin reinitiated Phase II, an action that ensured completion of all inspections by 1995.⁸ The success of the Wyoming agreement, and its rapid completion, indicated both nations were willing and ready to proceed beyond simple verification and actually begin dismantling their arsenals.

Bilateral Destruction Agreement of 1990

The Bilateral Destruction Agreement (BDA) formalized the destruction of chemical stockpiles, to begin by December 1992. Both nations agreed upon a ten-year destruction period with a completion date of December 2002. However, each nation is permitted to retain an agent stockpile of 5,000 tons as a hedge against each other and against those nations not covered by the bilateral agreement.⁹ For the US this tonnage is further reduced after 2002 by Public Law 99-145. Not by 2002, but before 2004, the US is

required to completely destroy its unitary stockpile. With the unitary stockpile destroyed, the US will possess only its 680 tons of binary weapons. Russia has no similar law requiring them to reduce below 5,000 tons. Critics consider this a major flaw in the BDA. They forget that Public Law 99-145 was unilateral in its passage and that nothing is lost that wasn't already identified for elimination.

A significant provision of the BDA is the exchange of continuous presence inspectors who reside at the opposing state's storage sites and destruction facilities. The inspectors will have complete access to all facilities and monitor the demilitarization process. Through this exchange, each party will have access to facilities to monitor the near real-time status of operations. Besides the inspectors, various experts will also be on-site to exchange technological information and assist in the complete and safe destruction of CW stockpiles.

Nunn-Lugar Act of 1991

It was apparent after the fall of the Soviet Union that external funding was needed to prevent the diversion of any of the more than 30,000 nuclear warheads and other WMDs located in the former Soviet republics. That financial support came in the form of the Cooperative Threat Reduction (CTR or Nunn-Lugar) Act of 1991. It provided funding assistance to control proliferation and initiate demilitarization of all classes of WMDs.¹⁰ Under the CTR, Congress provided the Secretary of Defense (SecDef) the funding and authorization to sign agreements and contracts to assist Russia and the former Soviet republics in demilitarizing their WMDs. Total funding authorization to date is \$1.236 billion with \$866.3 currently obligated.¹¹

The CTR has six objectives established by Congress.¹² They are as follows:

1. Assist the former Soviet state in destroying their WMDs.
2. Transport, store, disable, and safeguard weapons in the demilitarization process.
3. Establish verifiable safeguards against proliferation of WMDs.
4. Prevent diversion of weapon related scientific expertise.
5. Assist in demilitarization of military industries and technologies.
6. Expand defense and military contacts between the US and former Soviet states.

While targeted to assist the demilitarization and/or security of all WMDs, the bulk of CTR funding, to date, has been allocated to nuclear weapons programs. Between 1992 and 1995 CTR funding for CW demilitarization grew from a total of \$25 million to \$55 million. Unfortunately that CW total represents a mere 5 percent of all CTR obligations.¹³ That nuclear-first trend appears to have changed with the President's signing of the National Defense Authorization Act of 1996. The Act authorizes an additional \$196 million in CTR funding directed toward nuclear weapon programs and \$75 million directed toward constructing a chemical weapon demilitarization facility in Russia.¹⁴

Unfortunately the Department of Defense (DOD) rhetoric does not match the new CTR funding. In both the 1995 and 1996 Annual Reports to the President and Congress, the DOD dedicated the greater part of its report to the CTR nuclear achievements. Both reports contains less than a paragraph expressing departmental support for chemical weapon destruction. Hopefully, the 1997 report, to be released in April, will contain a significantly greater endorsement of the chemical demilitarization programs.

Although impressive in advertised scope of effort and commitment, the CTR has critics. At the annual conference of the American Association for the Advancement of Science, a Russian scientist bitterly complained that US assistance has yet to produce tangible results because the money was being spent on talk and little action.¹⁵ In addition

it should be noted that in the conversion of Russian military production facilities to civilian factories, the bulk of CTR spending has been to fund the work of US contractors, and not Russian firms.

Bilateral Chemical and Biological Weapons Agreement of 1992

1992 witnessed the fall of the USSR and an acknowledgment by the newly formed Russian government that it could not financially secure or destroy its WMDs. In an effort to keep previously negotiated demilitarization agreements on track, the US signed the Bilateral Chemical and Biological Weapons Agreement of 1992. Under the agreement, the US provides CTR funding assistance and shares demilitarization technologies with the new Russian government. The separate weapon destruction plans resulting from this agreement went to their respective national governments for review and authorization.

In the US, environmental and safety agendas presented by non-governmental organizations, site-adjacent communities, or state governments, put construction of most demilitarization plants on hold. Despite this delay the US opened one chemical demilitarization prototype plant in 1991 and one operational plant in 1996. The US destruction of its own arsenal is behind schedule, but proceeding nonetheless. The current congressional authorized completion date for unitary chemical weapon demilitarization is 2004, ten years past the original date of 1994.¹⁶ No such date has been established concerning binary chemical weapons.

The Russian government, on the other hand, has failed to successfully implement its CW demilitarization plan. When presented to the people, those residing near the proposed disposal sites did not like the plan for many of the same reasons their US counterparts

postponed facilities in their communities. The neutralization plant built at Chapayevsk never opened because nearby residents feared pollution similar to that endured under the USSR for many years. The Russian government set a new plan release date of December 1993 which it did not meet.¹⁷ No plan exists yet in 1997 and few expect Russia to begin actual destruction operations any time soon. Thus, it is obvious that the initiation of the 10-year destruction time period is slipping into the future. While the US and Russia bilateral disarmament programs falter, the world has not been sitting by idly. The work toward the multi-lateral CWC continued.

Australia Group

The work at the United Nations toward a chemical weapons convention was aided by the Australia Group. Formed in 1985, the Australia Group is an informal group of states with no charter or constitution. It functions by consensus and works together to stop the proliferation of chemical and biological weapons. The spark that inspired the group formation was the Iran-Iraq War and international concern that the materials used to develop chemical weapons during that war were bought as legal exports. Something had to be done and neither the CWC or any other instrument existed at that time to handle this clear violation of the 1925 Geneva Protocol. In 1990 the group added the task of limiting the proliferation of biological weapons to its responsibility.¹⁸ The organization meets annually to coordinate non-mandatory export controls on materials associated with the production of chemical or biological weapons and to promote greater reporting of transfers of such materials.

The group's material export control program publishes a chemical list and a technology list of export items used in the manufacture of chemical weapons. The chemical list includes those chemicals used solely for the production of weapon agents and dual-use chemicals with commercial applications. The technology list includes those equipment items or facilities related to chemical weapon manufacture. It places control judgment at the feet of the exporter to ensure potential misuses are identified before transfers or sales.¹⁹ The program does not impede normal trade activities, but helps control exports of chemical and biological materials and prevents diversion of materials to the production of chemical weapon agents. To that end, members of the group encourage non-member trading parties to adopt similar restrictive trade practices. The effect is that the group may only consist of 26 declared states, but many more states abide by its principles. A list of the Australia Group members is shown in Table 1.

Table 1. Members of the Australia Group

Argentina *	Germany *	New Zealand *
Australia *	Greece *	Norway *
Austria *	Hungary *	Portugal *
Belgium	Iceland	Spain *
Canada *	Ireland *	Sweden *
Denmark *	Italy *	Switzerland *
European Commission #	Japan *	United Kingdom *
Finland *	Luxembourg	United States
France *	Netherlands *	

Source: United States Arms Control and Disarmament Agency, Fact Sheet, July 28, 1993. Note: * CWC ratifications delivered, # Not a state entity-can neither sign or ratify

Eleven members of the group participated in the negotiations in the Conference of Disarmament in Geneva that led to the drafting of the CWC and all parties of the group signed the convention when opened for signature in Paris in 1993.²⁰ To date, all but the

United States and two other states have delivered their instruments of ratification. The group has formally acknowledged member willingness to resume trade in previously restricted materials as each states delivers it instrument of ratification.

Notes

¹ Laurie H. Boulden, "The Importance of Ratifying the Chemical Weapons Convention," Chemical and Biological Weapons Nonproliferation Project, The Henry L. Stimson Center, 1.

² *Proliferation of Weapons of Mass Destruction: Assessing the Risks*, Office of Technology Assessment, August 1993:17, 106.

³Ibid.: 17.

⁴Charles Flowerree, "The Chemical Weapons Convention: A Milestone in International Security," *Arms Control Today* 22, no 8 (October 1992): 3.

⁵Paul Doty, "The Challenge of Destroying Chemical Weapons," *Arms Control Today* 22, no 8 (October 1992): 25.

⁶Public Law 99-145, November 1985.

⁷ "The Bilateral Memorandum of Understanding," The Stimson Center, available from http://www.stimson.org/pub/stimson/cwc/cwc_mubda.htm

⁸ "The Bilateral Memorandum of Understanding," Stimson Center, available from http://www.stimson.org/pub/stimson/cwc/cwc_mubda.htm

⁹Hugh D Crone., *Banning Chemical Weapons* (New York, NY: Press Syndicate, University of Cambridge, 1992): 95.

¹⁰William J. Perry, *Cooperative Threat Reduction*, Annual Report to the President and Congress, March 1996 (Department of Defense, 1996), 63-64.

¹¹William J. Perry, Secretary of Defense, *Annual Report to the President and the Congress*, Government Printing Office, March 1996:63-64.

¹² William J. Perry, Secretary of Defense, *Report of the Secretary of Defense to the President and the Congress*, Government Printing Office, February 1995.

¹³ "Russia Update," The Stimson Center, available from <http://www.stimson.org/pub/stimson/cwc/rusadv.htm>

¹⁴National Defense Authorization Act for Fiscal Year 1996, The Stimson Center, available from <http://www.stimson.org/pub/stimson/rd-table/ctr96.htm>.

¹⁵ Igor Khripunov, "Russia's Arms Trade in the Post-Cold War Period," *The Washington Quarterly*, Autumn 1994.

¹⁶Ibid.

¹⁷ "Ratifying the Chemical Weapons Convention," *The Center for Strategic and International Studies*, Vol. XVI, No 4 (Washington DC: Center for Strategic and International Studies), 1994: 112.

¹⁸United States Arms Control and Disarmament Agency, Occasional Paper, May 18, 1993: 1-2.

¹⁹United States Arms Control and Disarmament Agency, Fact Sheet, October 25, 1993.

Notes

²⁰United States Arms Control and Disarmament Agency, Occasional Paper, May 18, 1993: 4.

Chapter 2

Chemical Weapons Convention

If the Chemical Weapons Convention (CWC) is to serve its purpose, its membership will have to become truly global. The objective is the effective establishment of a new international norm—a ban on the possession of chemical weapons—and such norms are only established when agreed to by the great majority of states, including all or nearly all major states.

—James F. Leonard

History

What began as a US-initiated, 40-state effort to ban chemical weapons in 1968, now nears completion. The CWC is the first treaty to combine weapon control and nonproliferation in a single agreement. It ultimately bans an entire class of weapons. The treaty prohibits development, production, transfer, acquisition, stockpiling, or retention of chemical weapons.¹ On January 13, 1993, the UN formally presented the treaty for signature. Immediately, 130 states signed the document.² Thirty more signed soon thereafter. All that remained to enter the agreement into force was the formal delivery of 65 state ratifying instruments. On October 31, 1996, the 65th ratification occurred—Hungary. The treaty enters into force (EIF) on April 29, 1997.³

The organization to manage the treaty falls under the United Nations (UN) with its headquarters at The Hague, Kingdom of the Netherlands. All ratifying states

automatically become members of this Organization for the Prevention of Chemical Weapons (OPCW). The OPCW is further divided in three organizations: the Conference of the States Parties; Executive Council; and Technical Secretariat. Until the CWC enters into force, a Preparatory Commission (PC) comprised of personnel from all of the signatories, has been busy building the infrastructure, drafting budgets, establishing inspection procedures, and recruiting personnel for the various teams. The work of the PC will permit the three divisions of the Convention to assume responsibility and begin verification of the treaty within 30 days of the treaty entering into force.

The Conference of States Parties

Comprised of one voting member and associated advisers from each ratifying state, it is the principal organ of the OPCW and is responsible for implementing the convention. The inaugural session, to be repeated annually, is scheduled to convene on May 6, 1997. The Conference is responsible for establishing organizational procedures and making decisions on matters of substance relative to the powers and functions of both the Executive Council and Technical Secretariat. The Conference will, on a five-year cycle, convene a special session to examine CWC operations and to review relevant scientific and technological developments affecting demilitarization.⁴

The Executive Council

Consists of 41 members, representing 6 global regions, elected by and from the Conference of State Parties. Membership rotates every two-years; however, the initial Council will have 20 members elected to one-year terms to produce a tenure offset. In addition, the members within each region are further categorized by their status as an

international chemical industry and by examining their political sensitivities and security concerns. In effect, actual membership rotation is complicated. The greatest membership change will be among the less chemically powerful states of the various regions and those not in possession of or under the threat of chemical weapons. The chemically powerful states will rotate out of the Council only if they are surpassed industrially. The industrial ranking of each state is based on chemical output and is documented by international reports and data. Table 2 defines the composition of these regions.

Table 2. OPCW Executive Council Composition

Region	States Parties as Members to Executive Council	Memberships Reserved for Major Chemical States
Africa	9	3
Asia	9	4
Eastern Europe	5	1
Latin America & Caribbean	7	3
Western Europe & Other	10	5
Asia/ Latin America & Caribbean	1	To rotate between the three areas of this region

Source: Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction.

The Council functions as the executive organ of the OPCW. As such, it drafts the programs and budgets to be voted on by the Conference and serves as the agent for concluding agreements with states and international organization. These agreements include verification implementation and issues concerning treaty compliance. If the Council is unsatisfied with a state response to questions of compliance, it may elevate the issue to the Conference or to the UN General Assembly or Security Council.⁵

The Technical Secretariat

The Secretariat consists of a Director-General as head administrative officer, inspectors, scientists, technicians, and other personnel as required. Only citizens of member states shall serve in any professional or clerical capacity. The Director-General is appointed by the Conference of States and in turn aids the Conference in appointing members to the Secretariat's Scientific Advisory Board and to any recommended working groups. Members to the Board or groups are selected solely on their expertise, efficiency, competence, and integrity relative to the CWC and shall represent a wide geographical basis.

The Technical Secretariat provides the administrative and technical support to the Conference and the Council in addition to serving as the verification and inspection agency for the CWC. It is the communications focus for the OPCW and provides technical assistance to all States Parties concerning the convention and/or any other task requested by the Conference or the Council. Within 180 days of the EIF date, the Secretariat must establish an international stockpile of emergency and humanitarian supplies and funds to aid any state subject to a chemical attack. Most importantly, in an effort to discourage undue influence over the performance of their duties, no member of the Secretariat shall seek or receive any instructions from any government or external agency.⁶

Status

Despite President Clinton's 1993 address to the United Nations General Assembly in which he called on all nations to ratify the CWC by July 1994, so that it might enter into force at the earliest possible date, it did not happen in the United States.⁷ Four years

later, during his 1997 State of the Union Address, President Clinton was still asking the US Senate to ratify the convention. Of the 161 states that signed the CWC, only 70 have delivered instruments of ratification as of March 1997. That list of signatory states with their delivery status is in Annex A.

The low number of delivered ratifications is rather disappointing since the instruments of the US, Russia, and China are among those absent. For those states that have not delivered their instruments, non-membership and/or late ratification have significant prices to be paid. By not being within the first 65 to ratify, a state forfeits any honor of being selected as one of the 41 charter members of the OPCW Executive Council. By not ratifying before May 6, 1997, the first meeting of the CSP, a state cannot be a member of the Technical Secretariat or a party to its international inspection teams.⁸ Failure to be part of the Technical Secretariat at the beginning means that it could be a year or more before positions vacate and are replaced through OPCW general elections. That first year is the most important as the members construct the organization, draft procedures, and established organizational will.

Failure to ratify the convention after May 6, 1997, has even more grave consequences. For three years following April 29, 1997, non-members must submit buyer-user forms when dealing in chemical trade with member states. This may appear as only a slight inconvenience to some nations; however, five years after the EIF date, the list of restricted chemicals may and most probably will expand greatly. A total ban on certain chemicals sales to non-members is possible if the limited trade policy does not persuade membership. In the extreme, this represents a potential trade loss to the US chemical industry of hundreds of millions of dollars.⁹

The failure of the US and Russia to ratify the CWC threatens to doom the entire operation. Unless the remaining nations can provide the financial support withheld by the US, it is unlikely global CWC verification can proceed. The OPCW expects US funding support for 25 percent of the 70 million dollars needed for the first year inspections. Subsequent annual inspection requirements exceed 170 million dollars.¹⁰ The additional loss of Russia and China funding would undoubtedly make the effort nearly impossible.

Notes

¹Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, Article I, General Obligations, October 1993.

² “Signatures and Ratifications,” Stimson Center, available from <http://www.opcw.nl/info.htm>

³Ibid.

⁴ “Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction,” United States Arms Control and Disarmament Agency, October 1993, 22-24.

⁵Ibid., 24-28.

⁶Ibid., 28-30.

⁷ “Ratification and Adherence to the Chemical Weapons Convention,” United States Arms Control and Disarmament Agency, Issues Brief, September 1993.

⁸ “Army Chemical Treaties Implementation,” *On-Line News*, November 21, 1996, WWW available from jhselzer@cbdcom.apgea.army.mil

⁹Michael Moodie, “Ratifying the Chemical Weapons Convention: Past Time for Action,” *Arms Control Today*, February 1996, 6-7.

¹⁰ Moodie, 7.

Chapter 3

Demilitarization

The United States can certainly do it if Congress provides the funds, and if the chemical demilitarization program does not run into political difficulties at the various destruction sites.

—Stephen J. Ledogar

Current Technology

So what exactly have we destroyed and how have we destroyed it? In the 1970s the US Army experimented with neutralization and incineration at its Rocky Mountain Arsenal in Colorado. These technologies became standards after the past practices of ocean dumping, open pit burning, and land dumping became unacceptable. After careful research, the incineration process provided a 99.9999995 percent destruction efficiency rating.¹ The Environmental Protection Agency (EPA) requirement at the time was only 99.99 percent for hazardous materials. However, local governments in the vicinity of the storage and disposal sites and non-governmental agencies concerned about the destruction process succeeded in getting the EPA requirement tightened to 99.9999 percent—still well within the capability of incineration.

The US built the Johnston Island and Tooele facilities to the demonstrated 99.9999995 capability. Unfortunately, emotional, non-scientific protests continued and

what remaining popular support had previously existed for incineration then vanished. Past military-civilian incidents in which the military was not completely honest sowed seeds of doubt and distrust. Failure on the part of the Army to recognize growing distrust and address it properly led to delayed improvements in military-civilian cooperation. As a result, the military found itself forced to evaluate alternative proposals no more efficient than incineration. Congress even allocated \$40 million of the defense budget to research these options.

Alternative Technologies

In 1993 the National Research Council (NRC) recommended that incineration continue while the Army evaluated alternative technologies. These technology proposals, requested of the international civilian and corporate worlds, were for existing capabilities in use today. Proven technologies were needed due to the CWC time constraints. It is highly improbable that the US could develop and mature new technologies and complete the demilitarization process by 2007. The Army selected the following handful of viable technologies to evaluate:

Neutralization

The mixing of an agent with a second substance or combination of substances to reduce or eliminate the toxicity level is called neutralization. For mustard that substance appears to be simple hot water, for nerve agent it is sodium hydroxide (bleach) and room temperature water. Both processes produce biodegradable products, but significantly larger volumes of waste. These wastes require additional, not yet defined, treatment before disposal.²

Transport of any waste bearing a toxic classification is unacceptable to local communities, making neutralization by itself an incomplete substitution for incineration. Therefore, the waste must be destroyed or further degraded to politically acceptable levels to permit transport from the facility for final disposal. Burial, incineration, or some other process must follow the neutralization operation.

Neutralization followed by Biodegradation

Biodegradation is similar to the neutralization process except the decomposition products receive additional treatment in the form of bacterial degradation. In the case of mustard it is mixed with sludge where bacteria break the mixture down to gas, solid, and liquid states, each of which is non-toxic³. Historic community resistance to placing human sewage sludge on crop fields, makes it is extremely unlikely that neutralization sludge will be disposed of other than through burial in politically acceptable sites. Because they were associated with chemical weapon agents, the waste products will probably be treated as toxic substances even during final disposal.

Nerve agents on the other hand are not so easily neutralized, no one has yet identified a biological agent to complete the breakdown process.⁴ So, only a partial solution exists. This does not soothe local concerns about transporting toxic wastes through communities or the incineration of toxic substances on site.

Catalytic Extraction Process

Commonly referred to as molten metal or CEP. CEP recycles all agents and associated materials into industrial products. Technicians inject the agent or contaminated materials into a molten pool of metal. The extremely high temperature causes the

materials to disassociate into basic elements (solids, liquids, gases). The various elements then recombine via reagents and catalysts to produce industrial products or in the case of other metals, are recovered as solids and liquids. This technology is currently used to destroy pesticides, solvents, and metals and meets the 99.999999 efficiency rating requirement.⁵

Another significant advantage of CEP is the lack of an open incineration flame which reduces the possibility of fire or explosion. Combined with a sealed environment, this fully transportable facility reduces the cost of construction and limits the exposure of personnel to the reduction process and to chemical agents. Overall savings in construction time and cost are unknown since this technology must be combined with the reverse manufacture of weapons prior to the actual destruction of the collected agent. The Environmental Protection Agency (EPA) designated the CEP technology as the best alternative for wastes previously destroyed by incineration.⁶

China selected CEP as the technology it will use to destroy the more than two million chemical weapons left there after WWII.⁷ Although the Chinese will do the demilitarization of the munitions, the Japanese have to fund the effort since the weapons are Japanese ordinance left on foreign territory. The total cost to the Japanese is anticipated to be \$11 billion.⁸

Electrochemical Oxidation

Commonly referred to as Silver II, electrochemical oxidation was originally designed to destroy organic compounds produced during reprocessing of nuclear fuels. It utilizes two tanks (cells) separated by a membrane that prevents the mixing of the two cells, but allows transport of ions. A highly reactive form of silver resides in the cell with the agent.

An electrical current similar to common electroplating activates the process. The reactive silver attacks the organic compounds and destroys them. The process is extremely safe in that the temperature of the liquid remains below the boiling point and can be turned off instantly by removing electrical power. The gases produced must be processed through a charcoal bed similar to that used during incineration.⁹ Waste products are carbon dioxide, water, and inorganic substances.

High Temperature Gas Phase Reduction

High temperature gas phase reduction mixes agents (solid, liquid, gas) and other liquids or gases with hydrogen at 1,562 degrees Fahrenheit where destruction takes place in less than one second. Chlorinated hydrocarbons reduce to methane and hydrogen chloride. Non-chlorinated organic compounds reduce to methane and light hydrocarbons. Other basic products of the reaction process are carbon dioxide, carbon monoxide, and water.¹⁰ All resultant wastes are recyclable, reusable or disposable products. In addition, this technology employs a closed loop technique that eliminates any possibility of uncontrolled emissions and has a demonstrated efficiency of 99.9999 percent.

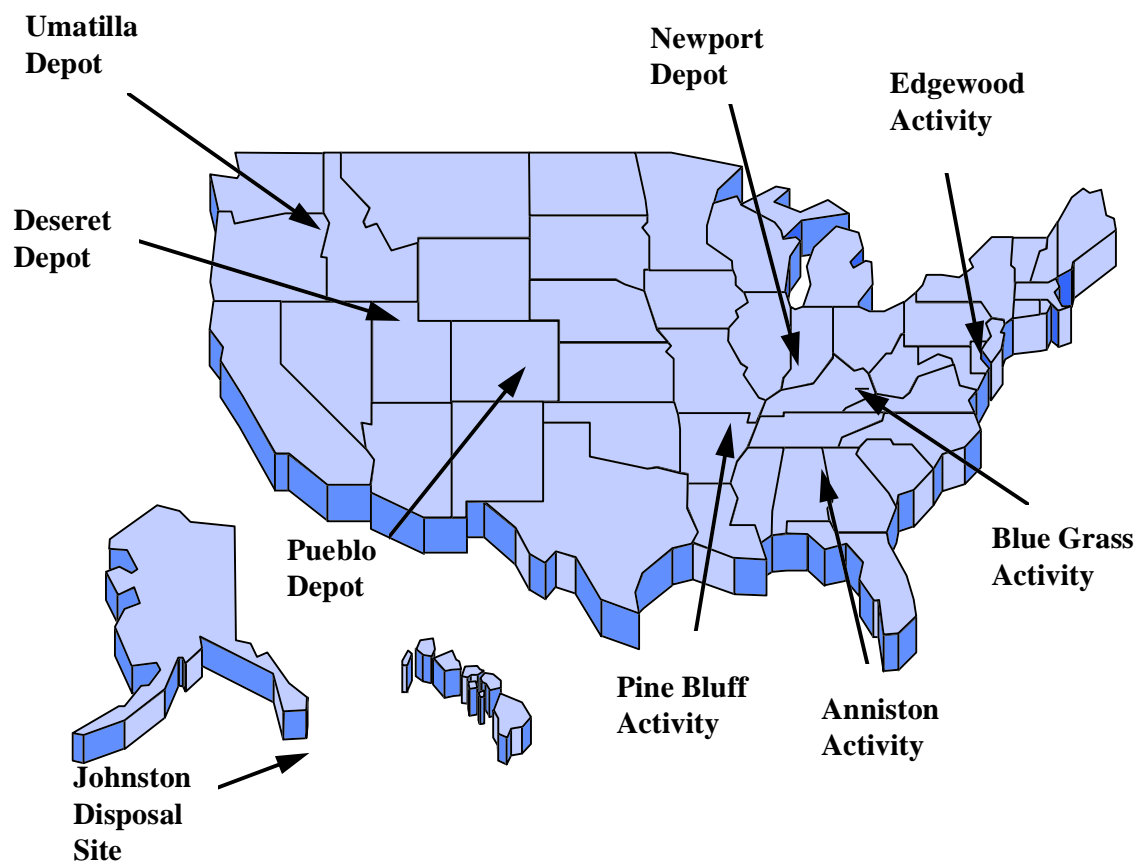
As a self-contained, mobile unit, gas phase reduction technology also reduces the cost of construction and shelters personnel from the hazards found in standard incineration facilities. Overall saving in construction are unknown since this technology also requires reverse manufacture of weapons prior to the actual destruction of the collected agent.

US Status

The NRC and the Army released their findings on alternative technologies in a September, 1996 report. In the Program Manager for Chemical Demilitarization (PMCD)

report, incineration is the preferred process; however, public opinion is so negative that it is not an option. Therefore, for mustard the preferred treatment is neutralization followed by biodegradation. It performed best except for its cost—still considered less negative than incineration’s poor public opinion. Nerve agent is also best handled by neutralization, even though the lack of biodegradation means waste products must be shipped to another site for future treatment. The PMCD report, the NRC, the Citizens Advisory Commissions, and the Product Manager for Chemical Stockpile Disposal are the tools and agencies to formulate a new national policy.¹¹

Regardless the final policy, the actual process of demilitarization is, to date, purely US in nature. Although the US plan was slow in starting and delays exist in constructing the demilitarization facilities, the destruction of weapons and agent began in 1990 at the Johnston Atoll incinerator.¹² The Tooele incinerator in Utah passed its operational validation test and began operationally destroying munitions and agent in 1996.¹³ With the exception of the Anniston, Alabama plant, the remaining plants are tied up in political delays associated with environment and safety protests from non-government organizations, nearby cities, and/or state governments. Construction of the Anniston plant begins in 1997. The locations of all US sites are shown in illustration 1 below.



Source: PMCD, available from <http://www-pmcd.apgea.army.mil/csdp>.

Figure 1. US CW Storage Sites

Johnston Atoll and Tooele hold a combined 48.9 percent of the US stockpile in chemical agent.¹⁴ Their records as of March 24, 1997 are listed at table 3.

Table 3. Agent/Weapon Destruction as of 3/24/97

Demilitarization Site	Johnston Atoll	Tooele
Agent	2.2M pounds	397,241 pounds
M55 Rockets	71,997	11,592
Ton Containers	134 *	178
Bombs	5,617 *	0
Projectiles	45,108 *	0
Mines/Mortars/Warheads	64,940	0

Source: Michele Jewett, US Army, APG/CDRA, <http://www.mjewett@CDRA.APGEA>.

Note: * All stored weapons of this type have been destroyed.

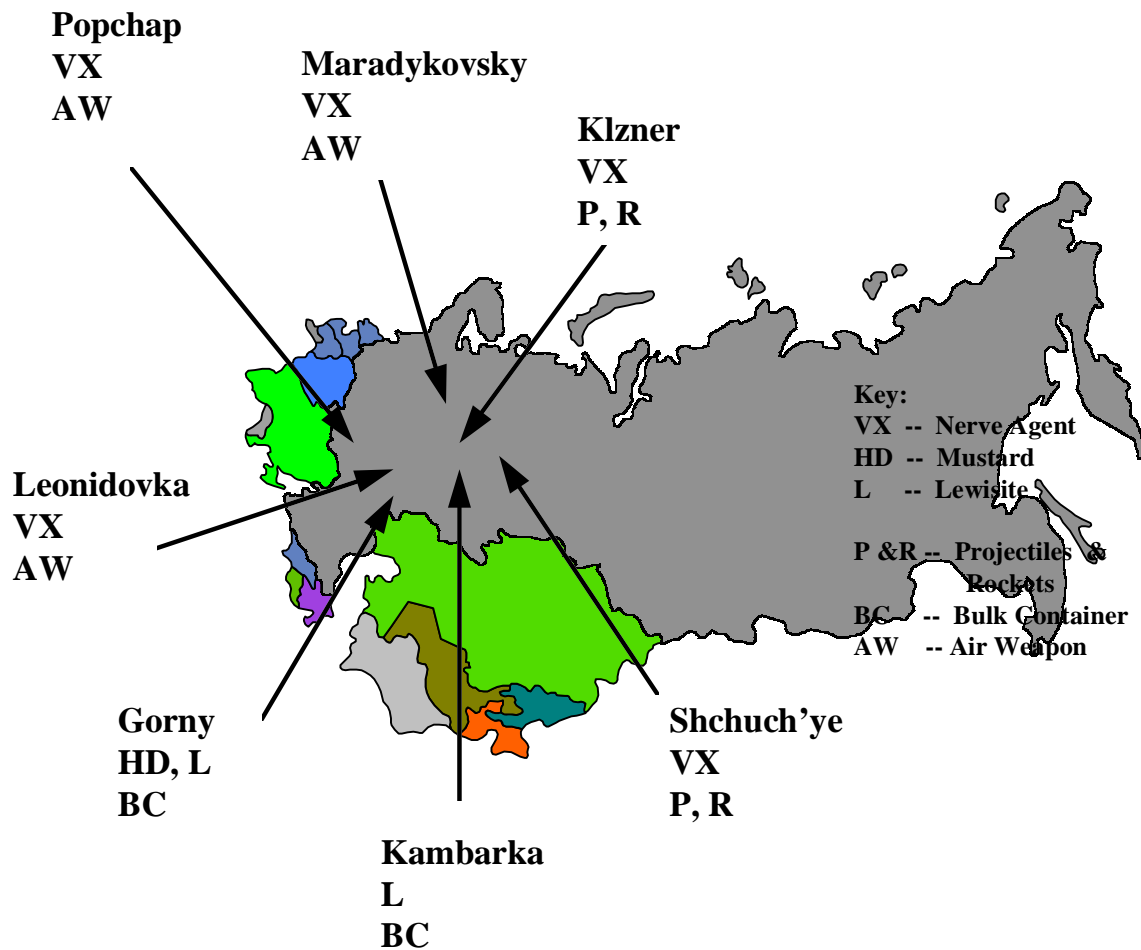
The process of demilitarization within the US is reverse manufacture (disassembly) of the weapons followed by incineration of agent, munitions parts, and all materials exposed to the munitions during storage, handling, or processing. Demilitarization requires four incinerators/furnaces: a liquid incinerator for actual destruction of recovered agents; a deactivation furnace that destroys the explosive and fuze components; a metal parts furnace that heats and sterilizes the metal parts of the disassembled munitions and/or storage vessels; and a dunnage incinerator that destroys packing and other minor materials.

A water entrapment system removes solid particulate from the exhaust gases produced during incineration. An evaporation system reduces the entrapment brine to salt for shipment to approved landfills. The salt itself is non-hazardous; however, the heavy metals (gold, lead, etc.) used in the manufacture of munitions contaminates the ash. The gases released during the incineration consist mainly of carbon dioxide and water vapor. To preclude any agent or hazardous gas releases, a vapor filtration system locks pollutants in a series of charcoal beds. Workers periodically destroy damaged or contaminated beds in the dunnage incinerator.¹⁵ This process has been used by the Army for over 20 years, and, as mentioned, obtains a 99.9999995 incineration rating.

Russia Status

With the downfall of the Soviet Union and the establishment of democracy in the new state, Russia no longer can ignore internal dissent to governmental actions. Today, the Russian government faces a grass roots resistance not only to its decision to destroy chemical agents, but also to how it plans to perform that destruction. The Russians, similar

to the US, plan to destroy their chemical weapons in place. The seven Russian sites are shown in illustration 2. With a price tag of \$5 to 8 billion, Russian authorities can only foresee having funding for 5 to 8 percent of the job. Some see the expenditure on weapon demilitarization as unnecessary when more important social issues demand attention. To prevent Russian slippage away from chemical demilitarization, the international community, presently provides funds and equipment to help keep the programs on track.¹⁶



Source: PMCD, available from <http://www-pmcd.apgea.army.mil/csdp>.

Figure 2. Russian CW Storage Sites

International funds pledged to date are: Germany, \$6 million; Netherlands, \$15 million; Sweden, \$6.7 million; and the US CTR funds. The US CTR funding includes

contracts to American companies renovating laboratories in Moscow and building a neutralization plant located in Kambarka.¹⁷ The laboratory project includes a central CW laboratory at the Moscow Research Institute of Organic Chemistry and Technology (GosNIIOKhT) and the purchase of three mobile laboratories. US CTR aid is also directed toward the construct of a CW destruction facility at Shchuch'ye in the Kurgan Oblast region and to converting the Khimprom CW production facility in Volgograd to non-military production.¹⁸

The demilitarization technology the Russian selected for lewesite is a two-step hydrolysis/electrolysis process that converts the agent into electronics grade arsenic. For the phospho-organic compounds neutralization has been selected. The mustard conversion process is a proprietary technology involving monoethyl amine with end products being reusable commercial products.¹⁹

Russian treaty compliance is a major concern. With the imminent ratification of the CWC in 1993, all efforts under the bilateral US-Russia agreements came to a halt. There is no current incentive or obligation for the Russian to comply with any agreement since the Federal Council has ratified none. A Russian whistleblower, Dr. Vil S. Mirzayanov, warns the US that tens of tons of new binary agents have been produced while the US and Russia argue internally over ratification. In his words he says, "If the CWC's procedures are not instituted, the Russian chemical weapons complex will remain accountable only to the same clique of leaders, who have thus far not proven their trustworthiness."²⁰ Many authorities believe the Russians will be forced to ratify the CWC under extreme international pressure, but only if the US leads the way.

The new Russian demilitarization plan, passed by the Duma on December 26, 1996, was rejected by the Federal Council on January 23, 1997. The project, which projected the start of mustard and lewisite destruction at the Gorny and Kambarka sites in 1998, was rejected for environmental safety reasons.²¹ The other five sites had scheduled to begin operations in the year 2000. All destruction was anticipated to be completed by 2005.²² Since none of the destruction facilities are currently under construction, the 2005 completion date is *very* ambitious.

Notes

¹Department of the Army, *U.S. Army's Alternate Demilitarization Technology Report for Congress, Executive Summary*, Program Manager for Chemical Demilitarization (Aberdeen Proving Ground, MD, April 1994): 2.

² "Demilitarization Technologies," Program Manager for Chemical Demilitarization Web Site, available from <http://www.pmc.d.apgea.army.mil/csdp>

³Ibid.

⁴Ibid.

⁵ Ibid.

⁶ "Catalytic Extraction Process," available from <http://m4web.m4lp.com/envtech/cep.html>

⁷ "Molten Metal's CEP Technology to Destroy China's Chemical Agents," *Chemical Engineering*, November 96, 44.

⁸Gerald Parkinson, "Chementator: Chemical Weapons Convention is Ratified, without the U.S. and Russia and Stockpile Destruction is Set to Begin," *Chemical Engineering*, December 1996, 19.

⁹ "Demilitarization Technologies," Program Manager for Chemical Demilitarization Web Site, available from <http://www.pmc.d.apgea.army.mil/csdp>

¹⁰ Ibid.

¹¹Program Manager for Chemical Demilitarization Web Site, "U.S. Army Program Manager for Chemical Demilitarization Alternative Technology Program Evaluation Report," (Draft), available from <http://www.pmc.d.apgea.army.mil/csdp>

¹² "Johnston Atoll," Program Manager for Chemical Demilitarization Web Site, available from <http://www.pmc.d.apgea.army.mil/csdp>

¹³ "Tooele," Program Manager for Chemical Demilitarization Web Site, available from <http://www.pmc.d.apgea.army.mil/csdp>

¹⁴Doty, 27.

¹⁵ "How will CW be Destroyed," Program Manager for Chemical Demilitarization Web Site, available from <http://www.pmc.d.apgea.army.mil/csdp>

Notes

¹⁶Gerald Parkinson, "Chementator: Chemical Weapons Convention is ratified without the U.S. and Russia and stockpile destruction is set to begin," *Chemical Engineering*, December 96, 19.

¹⁷Gerald Ondrey, "Chementator: Russia Faces CWC Dilemma," *Chemical Engineering*, December 1996, 48-49

¹⁸ "Chemical Demilitarization in Russia," The SIPRI Site, available from <http://www.sipri.se/projects/group-cw/BICC-SIPRI>.

¹⁹*Ibid.*, 48-49.

²⁰ "Chemical Weapons Disarmament in Russia: Problem and Prospects," available from <http://www.stimson.org/stimson/pub/>.

²¹ "Chemical Demilitarization In Russia," The SIPRI Site, available from <http://www.sipri.se/projects/group-cw/BICC-SIPRI>.

²²Ondrey, 48-49.

Chapter 4

Issues

From a military perspective, the Chemical Weapons Convention is clearly in our national interest. The Convention's advantages outweigh its shortcomings. The United States and all other CW-capable state parties incur the same obligation to destroy their chemical weapon stockpiles...if we do not join and [we] walk away from the CWC an awful lot of people will probably walk away from it as well, and our influence on the rogue states will only decrease.

—General John M. Shalikashvili
Senate Testimony, 23 June 1994

As mentioned earlier, not being one of the first 65 states to ratify the CWC has eliminated the US from becoming a founding member of the OPCW Executive Council. Unless the US completes ratification before May 6, 1997, it will lose any opportunity to serve as a member on the Technical Secretariat. As a result of this US ratification failure, other holders of large chemical stockpiles (Russia, possibly China) are withholding their own instruments of ratifications. This stalemate may jeopardize the success of the convention.

Internally, the US is faced with arguments both for and against ratification. These arguments are delivered by very important and knowledgeable people holding positions of authority in industry, military, and politics. Before discussing these arguments, let us examine two issues independent of these arguments. First, how will the US meet the destruction timelines required under the various agreements when political activism

slowed the construction of all but two of the planned incinerators? Second, the nature of chemical weapons makes them great terror weapons; perhaps more so than other weapons of greater military significance. To produce the levels of death and physical destruction associated with nuclear or biological weapons, chemical arms must be delivered using a large numbers of individual weapons or, if possible, using one massive volume of agent. The greatest threat from chemical weapons is from a mass delivery system such as a ballistic missile on concentrated troops or civilian populations. If these missiles or their technology were restricted, then chemical weapons and other WMDs would be greatly limited in their utility.

Insufficient Construction Rate of Planned Destruction Facilities

In his March, 1996 testimony before the US Senate Committee on Foreign Relations, Secretary of Defense William J. Perry referred to incineration as the US means of chemical weapon destruction.¹ Under the CWC, states ratifying the treaty must meet a rigorous timeline which is based on the EIF date: 1 percent in 3 years; 20 percent in 5 years; 45 percent in 7 years; and 100 percent in 10 years. At present, the US has only two operating demilitarization plants, one at Johnston Atoll and one at Tooele, Utah. Of the remaining seven plants planned for construction, only the Anniston, Alabama plant is near construction. The Anniston construction team breaks ground sometime in 1997—following a construction delay in excess of one year caused by anti-incineration activists.

These three plants, mentioned above, will demilitarize 55 percent of the US stockpile by 2004, making it possible for the US to meet the CWC 7-years destruction requirement. Of the remaining six demilitarization plants, located around the US, each is being delayed

for one activist reason or another. Construction dates are unavailable at this time. The NRC alternative technologies report identifies replacements for incineration; however, the impact on planned construction is unknown. These new technologies may fall victim to the same irrational public opinion that doomed the best technology—incineration.

If Congress mandates pilot production plants to demonstrate these new technologies, then just as the Johnston Atoll plant took eight years to come on line, new plants might also take a long time. The mobile, self contained design of several of the new technologies may alleviate some of the construction delay, but specifics are unavailable to support this thought. If it takes eight years to bring the next facility on-line, that would be the year 2005. The US would have to request a five year extension to the ten year CWC timeline of 2007. Such extensions are authorized in the CWC protocol, but are politically embarrassing.

It should also be noted that these new technologies do not eliminate the requirement to reverse manufacture the weapons prior to demilitarization. It is this reverse manufacture process that consumes the bulk of the current demilitarization effort. Other than easing the minds of critics, it is doubtful that the overall safety or actual destruction effort will differ greatly from the process used today to extract agent from weapons and incinerate it. So the delay in constructing demilitarization facilities has not made the process safer, only delayed the original construction dates and the end date for weapon demilitarization.

On the other hand, the fledgling democracy in Russia has faced many growing pains associated with its programs. An insufficiency of national funding and lack of knowledge in demilitarization technologies causes Russia to remain in the planning stage and

dependent on US assistance. Besides the funding and technology problems, Russia faces a population now willing to question the right of the government to construct demilitarization facilities near their towns as well as the environmental quality of those plants. The Russian plan initially established under the BDA is on hold as a new more acceptable plan evolves to meet the concerns of the people and government. Even with the CTR funding to assist in the construction of new demilitarization facilities, it is unlikely Russia will be able to meet the timeline defined in the CWC.

Proliferation of Ballistic Missile Delivery Systems

Chemical weapons are deliverable using the full spectrum of convention munitions. However, it is when such weapons are matched with ballistic missiles that the combination could become extremely efficient and effective. The Department of Defense listed 15 nations as having ballistic missiles in 1994 and estimates as many as 20 possessors by 2000. See Annex B for a list of states with CW and ballistic missile technology. Most of these governments claim they desire missiles to deter regional threats. If this is true, it is strange, then, that many of these nations have modified what were once regionally acceptable missiles to ones with ranges in excess of 2,000, 2,500 or even 7,000 kilometers.²

It was exactly this concern that led several western nations to organize the Missile Technology Control Regime (MTCR) in 1987. Their aim was to slow or stop the proliferation of nuclear weapon delivery technology, but clearly the argument applies to the other weapons of mass destruction. Every missile exporter is now signed or pledged to abide by the MTCR guidelines. Unfortunately, as with previous international

agreements and treaties, there is no means to verify compliance. In fact, several nations are rumored to be in violation. Unfortunately, the cat is out of the bag and many of those nations once dependent on imported weapons are now developing their own production facilities.³ In the not too distant future some of the truly rogue nations may be able to manufacture missiles capable of reaching more US allies and ultimately, the continental United States itself.

What is needed is an international missile convention based on the principles of the CWC: support of nonproliferation, declaration of capability, verification processes, and challenge inspections. If the anti-CWC contingent is correct, and small violations of chemical weapon development occur, then the means to deliver those weapons must be constrained. In order to hide covert missile development, states with concealed chemical weapon technology would have to manage multiple clandestine operations, a much more difficult task. Especially when atmospheric tests by US national technical means aid in verification of compliance with treaty law.

Arguments From Both Perspectives

Disarms Potential Enemies/Reduces Proliferation/Template for Future Treaties.

In an ideal world, treaty compliance would be total. No state would attempt to cheat or assist other states in violating the articles of any agreement. Unfortunately, in the real world, many states will not sign or ratify certain treaties for reasons that they feel compromise their sovereignty or economic basis. Others do not sign or ratify because they are rogue states that neither seek, nor accept, international meddling in their internal or external affairs. These rogue states disarm only when forced to under extreme

economic or political pressure or when faced with overwhelming military force. Iraq is an example of a state that resisted the political and economic pressures, only to succumb to military force when it lost the 1990-91 Gulf War.

Iraq's behavior represents a new and uncomfortable trend. Over the last 15 years there have been numerous allegations that smaller nations of the world are using chemical weapons during their military conflicts.⁴ On the other hand, the chemical superpowers prefer the flexibility and greater destructive capability of advanced conventional weaponry. Chemical weapons are becoming the poor state's WMD with regional military advantage being gained by overtly stating or at least not denying one's chemical capability. The suspicion that a state possesses chemical weapons forces adversaries to either develop defensive systems or to chemically arm themselves. It may also deter attacks on that state. The CWC breaks this do loop by providing defensive assistance to any CWC member threatened by chemical attack. In addition, CWC political pressures, diplomatic isolation, and international economic sanctions placed against aggressors can penalize proliferators or those who do not join the CWC. States recognizing this disadvantage to acquiring chemical weapons may also come to see the wisdom of chemical disarmament.

The CWC is a treaty that not only punishes members for violations of the articles, but also punishes states that fail to become members. Non-members are not only subject to economic sanctions, but are not afforded the same defensive umbrella offered members in good standing. The intent of this treaty and future treaties is to address the global good rather than the narrow interests of individual states. Former Secretary of State James A. Baker III, summed it up when he wrote about the US ratification debate, "It makes no

sense to argue that because a few pariah states refuse to join the convention the United States should line up with them rather than the rest of the world.”⁵

As for proliferation, the greatest single threat is from Russia and the former soviet states. The rogue states are well known and their actions can be monitored. Unfortunately, Russia is less controllable due to the size of the state and the degree of corruption within official channels. Until inspections teams arrive in country and start the process of securing that huge arsenal, the outside world will not know the full extent of the problem. Graham Turbiville notes the demise of the then Soviet Army, now Russian army, and the increased power of the Russian criminal element in diverting chemical weapons to third parties. For example, in 1995, Lieutenant General Anatoly Kuntsevich of the former Chemical Troops was criminally charged with delivering over 800 kilograms of restricted chemicals to Middle East buyers and with a subsequent attempted sale of another five-and-a-half tons.⁶ Without the CWC and its verification regime, there is little chance of stopping what may already be a fatal hemorrhage from this former superpower.

It is the penalty phase of the CWC that attracts so many. Without enforcement, the treaty would be no more effective than the frequently violated treaties of the past. Membership in past treaties was, in many cases, only a symbolic surrendering to the will of the powerful states. The powerful states were then free to interpret those treaties absent any international consensus. The CWC, will forever changed that mind set.

The CWC now is being viewed as the template for the coming revision of the Biological and Toxin Weapons Convention (BWC). It is ironic that the US was the state that worked to ensure the enforcement aspects of the treaty and now it may be the state that leads to its demise. As Senator Richard Lugar said, “If the US fails to ratify, it will wreck

the entire apparatus...other countries will find excuses not to comply.”⁷ US leadership is essential in the continuing effort to build better treaties. US failure with the CWC could doom more than this one treaty.

Intelligence Tool Against Adversaries/ Verification is Poor/Cheating is Easy

Former CIA director James Woolsey testified that “the chemical weapons problem is so difficult from an intelligence perspective that I cannot state that we have high confidence in our ability to detect noncompliance, especially on a small scale.”⁸ The verification aspect of the treaty is indeed flawed in that only declared facilities of member states are open to inspection. The implication is that rogue and dishonest state can avoid inspection merely by withholding permission to inspect undeclared sites or by limiting the number of declared sites. It therefore appears the verification process would not stop toxic chemical production as desired, but rather only increase the price of such illegal activities.⁹

Director Woolsey’s concerns fall in line with a great number of other people. What do the other states have and how much do they have? As the US found out in the Gulf War, it is easy to conceal weapon development programs and stockpiles. The US was totally unprepared for the size of program the Iraqi military possessed.¹⁰ Other closed societies such as Iran, North Korea, and Libya pose equally real threats with programs the US also knows little about. Even closer to home, the fact that Dr. Vil S. Mirayanov shed light on a covert Russian chemical development program designing a new agent shows that friendly states are capable of exploiting loopholes or violating the intent of treaties.¹¹

However, a greater number of people feel that the only way the US can gain better access to global programs is via the CWC and its ratification process. Unless a state is a

member in good standing, its citizens are ineligible from serving in the Technical Secretariat or on its inspection teams. Being in the service of the inspection teams is key to gaining critical information of other states.

In order to deliver a ratification, the state must acknowledge its chemical program to include sites, types, and quantities. Even industries involved in the production or use of chemicals on the UN schedules of restricted chemicals must be identified for verification inspection. This data is deliverable only to other members of the convention. With membership comes vulnerability to short-notice challenge inspections conducted by the Technical Secretariat. On the other hand, until they become members, states are subject to both the international political pressure to become members and to the ever increasing economic sanctions directed toward their chemical industries.

Opponents to US ratification quickly note that inspections are only against declared sites and any attempt to expand inspection is at the host state's leisure. In reality, the political pressures to prove compliance will prevent states from putting up inflated defenses against expanded inspections. If the matter cannot be resolved by the OPCW, then the UN General Assembly becomes the decision body and the offending state's membership is in jeopardy. Loss of membership would be a steep political and economic cost.

Concerns have also been raised about compromising corporate proprietary information during inspections. For those states seeking to use the convention as a means of obtaining proprietary information, such actions are against treaty articles. The Preparatory Commission, acting for the future Technical Secretariat, and the US addressed that issue and constructed barriers against disclosures.

So, if the US wishes to participate in the data flow between members and have individuals on the inspection teams visiting these international sites, then it has to complete ratification of the CWC. Failure to do so will leave the US with no better intelligence that it has today. That is one less avenue for getting information regarding CW stockpiles of rogue nations.

Legal Leverage Against Non-membership and Treaty Violators

For the first time, a treaty is about to enter into force that has legal penalties to pay for noncompliance. As with the MTCR and other nonproliferation agreements, China, North Korea, Germany, France, and other European states have a history of openly ignoring trade restrictions. Their reasons for violating the agreements are tied to the lucrative sales found in weapon technology and the fact that few legal restraints existed.¹² Also, companies pursuing profits sometimes violate national export laws and go undetected by understaffed or disinterested governments. Under the CWC, if caught in a violation, they would be subject to expulsion from the convention and could potentially suffer trade restriction penalties. The US chemical industry, alone, estimates a significant impact to its \$60 billion annual international trade if ratification fails. That revenue would be cut off as a penalty for non-membership. The impact to the smaller, more specialized chemical industries of developing states would be even more severe. Members with evidence of treaty violations by others can request the OPCW to dispatch an international inspection team to determine compliance or noncompliance. No such tool exists today without the CWC.

Laurie Boulden of the Henry L. Stimson Center points out the legal dilemma for the US and other states if the US fails to ratify the convention. In her article “The Importance

of Ratifying the Conventional Weapons Convention,” she notes that many of the other chemical superpowers will not feel obligated to disarm if the US refuses to reciprocate, or even worse, fails to ratify the convention. She further notes that CWC member-states probably would hesitate to endorse a US preemptive strike against an alleged proliferation site unless the US were also a CWC member.¹³ If the US fails to become a full fledged member of the CWC, its international status will no better than a rogue state that it condemns today. No state would propose or conduct a preemptive strike against US chemical facilities; however, member states would begin immediate restrictions and monitoring of chemical trade with US industries.

Treaty will Protect U.S. Chemical Trade Industry/Regulates International Trade

In any discussion of the arguments relative to the CWC, the greatest obstacle to ratification is the Senate of the United States. The Senate almost presented the treaty for formal ratification in May of 1996; however, the approaching presidential elections made that action politically unacceptable. President Clinton, sensing an embarrassing defeat for ratification, withdrew the treaty from consideration until after the elections. Today, US Senators belonging to the Republican party threaten to continue withholding the treaty from a ratification vote. One of their stated major concerns is that it places excessive administrative burdens on US businesses. The proponents see this as a facetious argument since the US chemical industry publicly supports treaty ratification.¹⁴

The US has an annual \$60 billion in chemical trade at risk. The loss of international chemical markets with CWC members could, over a period of years, reach into the hundreds of millions of dollars since every major US chemical trade partner has signed and ratified the convention. If the convention manages to hold together without the US,

Russia, and China, then the US trading sphere will be reduced to such states as Libya, North Korea, Iran, and the other rogues. This scenario is highly unlikely, as noted in a recent interview with a high ranking CIA official. In the interview, the official doubted seriously that Europe or any other state would restrict chemical trade with a non-member US, because, “ world trade is just too dependent on US products and supplies.”

Is this CIA view valid or would the developing states of the world look at a non-member US as an economic windfall? Many of the developing state have small but growing chemical industries and could possibly fill the massive void left by the US. Most international dealers in chemical trade attempt to limited their number of suppliers in order to reduce transportation costs. That means when an international trader switches suppliers for one chemical, unless other contracted chemicals are unique to the previous supplier, the entire portfolio will transfer to the new account. In other words, the loss to the US would be greater than just the chemicals regulated by the CWC.

Forces Undue Costs on Business/Violates Constitutional Rights of Companies

One of the most frequent arguments against the CWC is the perception that massive numbers of inspectors will flood the country and set siege to the US chemical industry. Some predict large and small companies will be burdened with hundreds of millions of dollars of debilitating regulatory requirements. The Heritage Foundation estimates the annual cost to comply at \$200 million, while the Chemical Manufactures Association (CMA) says it will only cost \$250,000.¹⁵ The answer probably lies somewhere in between these extremes because the Heritage Foundation calculates the cost based on all companies having the same regulatory requirements and costs, while the CMA is very liberal in its estimates.

Some question the constitutionality of the CWC inspection process, labeling it as a violation of due process. Former Judge Robert Bork even sees questions of Fifth Amendment rights against self-incrimination. These concerns are strange since Article VII of the CWC directs US verification activities to unfold in accordance with the Constitution. To emphasize this, former White House Council C. Boyden Grey stated that Congress has “both the opportunity and obligation to incorporate any constitutional protections it feels may be lacking in the Constitution itself.”¹⁶ In actuality, each declared site will negotiate with the inspectors to define the specific process of inspection. Also, the sites are not obligated to answer invalid questions or allow excessive inspection of records or facilities if the actions are deemed unrelated to the inspection or are outside reasonability. The US CMA and other chemical associations endorse the CWC and worked with the Preparatory Council to develop the US inspection procedures and tested them at actual facilities. So the question must be asked, who is truly correct about the intrusiveness of the CWC inspections, certain anti-CWC lawmakers or the people in jeopardy of losing billions of dollars in global trade. One suggestion is to follow the money.

Loss of In-kind Retaliation/Must Maintain Full CW Defense Capability

Although CWC proponents continuously tout the convention’s restriction against possession of chemical weapons, it falls severely short of that position. In fact, two chemicals successfully employed during WWI are not prohibited, phosgene and hydrogen cyanide. The reason these gases are not restricted is that they are too widely used in chemical manufacturing to realistically monitor their distribution or use. This one

exception proves the fallacy in any comprehensive attempt to devise a list to ban or control weapon related chemicals.¹⁷

Russia's suspected new binary agent, reported by Dr. Mirzayanov, is rumored to be a product of atypical chemicals. If the rumors are correct and research continues unabated, then the controlled chemical schedules of the CWC are overcome by technology and the US policy of response-in-kind may be void. How then does the US respond to a chemical attack if its own chemical arsenal is gone? One answer is to do exactly as President Bush did when he disavowed the use of chemical weapons while at the same time warning Iraq that the US would respond to such an attack "disproportionately." Saddam Hussein interpreted that statement to mean nuclear.¹⁸ The Pentagon even acknowledges that some chemicals could elude the inspectors, but not in military significant numbers.¹⁹ As a result, the utility of chemical weapons fades as a state advances in precision, brilliant, and high technology weaponry as the US demonstrated during Desert Storm.

The fact that rogue or covert chemical programs will continue to exist whether there is a CWC or not requires the US to maintain an expensive and ever-improving defensive capability. That is simply something the US must live with, as was exemplified by the quantity of defensive precautions taken during Desert Storm. The ability of the allied forces to engage and destroy much of Iraq's chemical arsenal with high technology weapons shows that the best defense may be a good conventional offense.

Notes

¹ "The Chemical Weapons Convention," *ROA National Security Report*, February 1997, 1.

² John Spanier and Robert L. Wendzel, *Games Nations Play* (Washington, D.C., Congressional Quarterly Press, 1996), 541.

³ *Ibid.*, 540-41.

Notes

⁴ Johan Santesson, "The Advantages of Ratifying," available from <http://www.opcw.org/>.

⁵ James A. Baker 3rd, "Our Best Defense," *New York Times*, February 16, 1997, IV-13.

⁶ Graham H. Turbiville, Jr., "Weapons Proliferation and Organized Crime," *Airpower Journal*, Special Edition 1996, 17-23.

⁷ Carla Anne Robbins, "Chemical-Weapons Treaty Shapes Up as Messy Battle," *Wall Street Journal*, February 14, 1997, 1, 16.

⁸ Kyl, 10A.

⁹ Thomas Bernauer, "The End of Chemical Warfare," *Security Dialogue*, 1993, Vol. 24(1): 97-112.

¹⁰ David A. Kay, "Denial and Deception Practices of WMD Proliferators: Iraq and Beyond," *The Washington Quarterly*, Winter 1995, 18:1, 85-86.

¹¹ Senator Jon Kyl, "Bad Deal for U.S.," *USA Today*, 11 February 1997, 10A.

¹² *Ibid.*, 541.

¹³ Laurie H. Boulden, "The Importance of Ratifying the Chemical Weapons Convention," available from <http://www.stimson.org/pub/stimson/cwc/>.

¹⁴ Lois Ember, "Chemical Weapons Treaty Blocked," *Chemical & Engineering News*, September 16, 1996, 6.

¹⁵ Agnes Shanley, "CWC Moves on, Without the U.S., as Liability Suits Unfold," *Chemical and Engineering News*, October 1996, 46.

¹⁶ "The Chemical Weapons Convention, Constitutionality, and Unwarranted Fears," The Henry L. Stimson Center, available from <http://www.stimson.org/pub/stimson/cwc/>

¹⁷ *Ibid.*

¹⁸ Frederick J. Vogel, "The Chemical Weapons Convention: Strategic Implications for the United States," Strategic Studies Institute, Army War College, 1997, 11.

¹⁹ "A Chance to Ban Chemical Weapons," *New York Times*, January 12, 1997, IV-16.

Chapter 5

Conclusions

Gone are the days when America could rely on geographical distances to buy time until we could mobilize. Ballistic missiles and weapons of mass destruction have not only compressed geographical distances, but may also prevent U.S. forces from ever reaching the battlefield. The next war could be over by the time America is fully mobilized.

—Casper Weinberger, Peter Schweizer
The Next War

It is time the US faces up to the world leadership role it inherited following the collapse of the Soviet Union in 1992. The US must delivery its ratification of the CWC before the May 6, 1997 meeting of the Conference of the States Parties. Unless the most powerful nation on earth (economically and militarily) is willing to initiate the disarmament of weapons of mass destruction, then that global effort is a hopeless cause. Recent calls by past world military and political leaders to rid the earth of nuclear weapons shows the futility of retaining these relics. The conventional capabilities of many nations today assure a more precise, rapid and decisive strike against enemies than the indiscriminate WMDs of the past.

China and Russia await the US ratification to aid them in the chemical disarmament decision they also must make. The concerns that the treaty is not ideal or that other nations might not ratify it should not be limiting factors to US ratification. Rogue states will never be constrained through treaties. No matter what restrictions are placed on their

access to raw materials, evil parties , given the right drive and financial backing will obtain those materials. Is it not in the US interest to keep most of the world away from chemical weapons and to limit the size of the CW problem? Nuclear materials are much harder to obtain than chemical and biological, but none-the-less still obtainable. Just as Japanese terrorists were able to manufacture poison gas, so can state governments. The proper path to follow is the restriction of material availability as maintained through the accountability and verification articles of the CWC.

Finally, the economic sanctions against non-member states could prove disastrous to the US. The US fought hard to include these tough sanctions in the treaty as a means to induce all states into membership. The treaty was designed for the betterment of the world vice the individual desires of independent states. Unless the treaty has teeth to hold it together and ensure global compliance, it will go down as just another ineffective convention. The fact that some US individuals now find the treaty counter to their interests is good. What better test than to have the world's most powerful nation debate the usefulness of the treaty and find for its ratification? For if the US does not bend to the intent of the treaty, will any nation?

Appendix A

Signatories and Ratifications

Updated March 22, 1997

Signatories: 161 Ratifications: 70

Afghanistan

Bolivia

Albania—RATIFIED 5/11/94

Bosnia & Herzegovina—

Algeria—RATIFIED 8/14/95

RATIFIED 2/25/97

Argentina—RATIFIED 10/2/95

Brazil—RATIFIED 3/13/96

Armenia—RATIFIED 1/27/95

Brunei Darussalem

Australia—RATIFIED 5/6/94

Bulgaria—RATIFIED 8/10/94

Austria—RATIFIED 8/17/95

Burkina Faso

Azerbaijan

Burundi

Bahamas

Cambodia

Bahrain

Cameroon—RATIFIED 9/16/96

Bangladesh

Canada—RATIFIED 9/26/95

Belarus—RATIFIED 7/11/96

Cape Verde

Belgium—RATIFIED 1/27/97

Central African Republic

Benin

Chad

Chile—RATIFIED 7/11/96	Finland—RATIFIED 2/7/95
China	France—RATIFIED 3/3/95
Columbia	Gabon
Comoros	Gambia
Congo	Georgia—RATIFIED 11/27/95
Cook Islands—RATIFIED 7/15/94	Germany—RATIFIED 8/12/94
Costa Rica—RATIFIED 5/31/96	Ghana
Cote d'Ivoire—RATIFIED 12/18/95	Greece—RATIFIED 12/22/94
Croatia—RATIFIED 5/23/95	Guatemala
Cuba	Guinea
Cyprus	Guinea-Bissau
Czech Republic—RATIFIED 3/6/96	Guyana
Denmark—RATIFIED 7/13/95	Haiti
Djibouti	Holy See
Dominica	Honduras
Dominican Republic	Hungary—RATIFIED 10/31/96
Ecuador—RATIFIED 9/6/95	Iceland
El Salvador—RATIFIED 10/30/95	India—RATIFIED 9/3/96
Equatorial Guinea	Indonesia
Estonia	Iran
Ethiopia—RATIFIED 5/13/96	Ireland—RATIFIED 6/24/96
Fiji—RATIFIED 1/20/93	Israel

Italy—RATIFIED 12/8/95	Mexico—RATIFIED 8/29/94
Japan—RATIFIED 9/15/95	Micronesia
Kazakhstan	Moldova-8 July 1996
Kenya	Monaco—RATIFIED 6/1/95
Kuwait	Mongolia—RATIFIED 1/17/95
Kyrgyzstan	Morocco—RATIFIED 12/28/95
Laos—RATIFIED 2/25/97	Myanmar
Latvia—RATIFIED 7/23/96	Namibia—RATIFIED 11/27/95
Lesotho—RATIFIED 12/7/94	Nauru
Liberia	Nepal
Liechtenstein	Netherlands—RATIFIED 6/30/95
Lithuania	New Zealand—RATIFIED 7/15/96
Luxembourg	Nicaragua
Madagascar	Niger
Malawi	Nigeria
Malaysia	Norway—RATIFIED 4/7/94
Maldives—RATIFIED 5/31/94	Oman—RATIFIED 2/8/95
Mali	Pakistan
Malta	Panama
Marshall Islands	Papua New
Mauritania	Guinea—RATIFIED 4/17/96
Mauritius—RATIFIED 2/9/93	Paraguay—RATIFIED 12/1/94

Peru—RATIFIED 7/20/95	South Africa—RATIFIED 9/13/95
Philippines—RATIFIED 12/11/96	South Korea
Poland—RATIFIED 2/15/95 but deposited 8/23/95	Spain—RATIFIED 8/3/94
Portugal—RATIFIED 9/10/96	Sri Lanka—RATIFIED 8/19/94
Qatar	Swaziland—RATIFIED 11/20/96
Romania—RATIFIED 2/15/95	Sweden—RATIFIED 6/17/93
Russian Federation	Switzerland—RATIFIED 3/10/95
Rwanda	Tajikistan—RATIFIED 1/11/95
Saint Kitts and Nevis	Tanzania
Saint Lucia	Thailand
Saint Vincent and the Grenadines	Togo
Samoa	Tunisia
San Marino	Turkey
Saudi Arabia—RATIFIED 8/9/96	Turkmenistan—RATIFIED 9/29/94
Senegal	Uganda
Seychelles—RATIFIED 4/7/93	Ukraine
Sierra Leone	United Arab Emirates
Singapore	United Kingdom—RATIFIED 5/13/96
Slovak Republic—RATIFIED 10/27/95	United States
	Uruguay—RATIFIED 10/6/94
	Uzbekistan—RATIFIED 7/23/96
	Venezuela
	Viet Nam

Yemen

Zambia

Zaire

Zimbabwe

Appendix B

States' Chemical Weapon/Missile Capability

Region/State	Chemical Weapons	Missile Capability
NATO		
France	SP	S, I, L
United States	PC	S, L
Former Soviet Union		
Russia	PC	S, L
Kazakhstan	PP	S, L
Ukraine	PP	S, L
East and South Asia		
Afghanistan	PP	S
Myanmar	PP	
China	PP	S, I, L
Pakistan	SP	S
North Korea	PP	S, M, I
South Korea	SP	S
Taiwan	PP	S
Thailand	SP	
Vietnam	PP	
Middle East		
Egypt	PP	S
Iran	PC	S
Iraq	PC	S
Israel	PP	S, M
Syria	PP	S
Africa		
Ethiopia	PP	
Libya	SP	S
Somalia	SP	
South Africa	SP	
Latin/South America		
Cuba	SP	
Chile	SP	

Source: Zachary S. Davis, “Non-proliferation Regimes: Policies to Control the Spread of Nuclear, Chemical, and Biological Weapons and Missiles.

Key:

Chemical Weapons

PC Possession Confirmed

PP Probable Possession

SP Suspected Programs

Missile Capability

L Long Range (over 3,000 miles)

I Intermediate Range (up to 3,000 miles)

M Medium Range (up to 1,500 miles)

S Short Range (up to 600 miles)

Glossary

APG	Aberdeen Proving Grounds
APGEA	Aberdeen Proving Grounds Executive Agency
AU	Air University
AWC	Air War College
BDA	Bilateral Destruction Agreement of 1990
CBW	Bilateral Chemical and Biological Agreement of 1992
CDRA	
CSP	Conference of States Parties
CTR	Cooperative Threat Reduction Act of 1991
CW	Chemical Weapons, Chemical Warfare
CWC	Chemical Weapons Convention
EIF	Enter into Force
EPA	Environmental Protection Agency
DOD or DoD	Department of Defense
NRC	National Research Council
OPCW	Organization for the Prevention of Chemical Weapons
PC	Preparatory Council
PMCD	Program Manager for Chemical Demilitarization
RWP	Research Writing Paper
US	United States
USSR	Union of Soviet Socialist Republics
UN	United Nations
USAF	United States Air Force
WMD(s)	Weapon(s) of Mass Destruction
WWI	First World War, war to end all wars
WWII	Second World War

Bibliography

- Air Force Times Homepage, available at <http://www.armytimes.com/airhome.html>.
- Air War College, *Air University Style Guide for Writers and Editors*, 1996, n.p. On-line. Internet, 4 November 1996. Available from <http://www.au.af.mil/au/rco/style/>.
- Arms Control Today, CWC Special Issue*, October 1992.
- Army Chemical Treaties Implementation, November 21, 1996" *On Line News*, Available from jhselzer@cbdcom.apgea.army.mil.
- Baker, James A. 3rd, "Our Best Defense," *New York Times*, Section IV, February 16, 1997.
- Bernauer, Thomas, "The End of Chemical Warfare," *Security Dialogue*, Vol. 24(1), 1993.
- "The Bilateral Memorandum of Understanding," available from <http://www.stimson.org/pub/stimson/cwc/cwc.mubda.htm>.
- Boulden, Laurie H., "The Importance of Ratifying the Chemical Weapons Convention," available from <http://www.stimson.org/pub/stimson/cwc>.
- "Catalytic Extraction Process," available from <http://m4web.m4lp.com/envtech/cep.html>.
- Chemical Weapons Convention Homepage, available at <http://opcw.nl/ptshome.htm>.
- "The Chemical Weapons Convention," *ROA National Security Report*, February 1997.
- Chemical and Biological Weapon Web Resource, available at <http://www.fas.org/bwc/bwcweb.htm>.
- "The Chemical Weapons Convention: A Bad Deal for America," available at <http://heritage.org/hreitage/library/categories/natsec/bg999.html>.
- "The Chemical Weapons Convention, Constitutionality, and Unwarranted Fears," available from <http://www.stimson.org/pub/stimson/cwc/>.
- Chemical and Biological Warfare Web Site, available at <http://www.sipri.se/projects/chembio.html>.
- "Chemical Weapons Disarmament in Russia: Problems and Prospects," available from <http://www.stimson.org/pub/stimson/cwc/>.
- College of Aerospace Doctrine, Research, and Education. *AU Press Author Guide*. Maxwell AFB, Ala.: Air University Press, March 1995.
- College of Aerospace Doctrine, Research, and Education, *AU Press Style Guide for Writers & Editors*. Maxwell AFB, Ala.: Air University Press, December 1994.
- Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, United States Arms Control and Disarmament Agency, October 1993.
- Cooperative Monitoring Center Homepage, available at <http://www.cmc.sandia.gov/>.
- Cordesman, Anthony H., *Iran & Iraq: The Threat from the Northern Gulf*, San Francisco, Westview Press, 1994.

Crone, Hugh D., *Chemical Weapons*, New York, Press Syndicate, University of Cambridge, 1992.

Defense Link, Government Locator Service, Publications, News, available at <http://www.dtic.mil/defenselink>.

"Demilitarization Technologies," Program Manager for Chemical Demilitarization, available from <http://www.pmc.d.apgea.army.mil/csdp>.

Doty, Paul, "The Challenge of Destroying Chemical Weapons," *Arms Control Today*, CWC Special Issue, Vol 22, No 8, October 1992.

Ember, Lois, "Chemical Weapons Treaty Blocked," *Chemical & Engineering News*, September 16, 1996.

Fact Sheet, United States Arms Control and Disarmament Agency, October 25, 1993.

Flowerree, Charles, "The Chemical Weapons Convention: A Milestone in International Assessment," *Arms Control Today* 22, no 8, October 1992.

Glamser, Deeann, "Plan to incinerate nerve gas sets off alarms," *USA Today*, Section A, May 30, 1996.

The Henry L. Stimson Center, available at <http://www.stimson.org>.

"How will CW be Destroyed," available from <http://www.pmc.d.apgea.army.mil/csdp>.

"Johnston Atoll," available from <http://www.pmc.d.apgea.army.mil/csdp>.

Joseph, Robert G., "The Impact of NBC Proliferation on Doctrine and Operations," *Joint Force Quarterly*, Autumn 1996.

Kaminski, Paul G., "Counterproliferation: DOD Acquisition's Commitment," *Defense*, Issue 1, 1996.

Kay, David A., "Denial and Deception Practices of WMD Proliferators: Iraq and Beyond," *The Washington Quarterly*, Winter 1995.

Kay, David, "Detecting Cheating on Non-Proliferation Regimes: Lessons From Our Iraqi Experience," Air War College, April 26, 1996.

Khripunov, Igor, "Russia's Arms Trade in the Post-Cold war Period," *The Washington Quarterly*, Autumn 1994.

Krepon, Michael, "A New era in Verification," *Arms Control Today*, CWC Special Issue, Vol 22, No 8 October 1992.

Kyl, Jon, "Bad Deal for U.S.," *USA Today*, Section A, February 11, 1997.

Ledogar, Stephen, J., "The End of the Negotiations," *Arms Control Today*, CWC Special Issue, Vol. 22, No 8 October 1992.

Leonard, James, F., "Rolling Back Proliferation," *Arms Control Today*, CWC Special Issue, Vol. 22, No 8 October 1992.

Making Americans Safer: The Case for the Chemical Weapons Convention CWC, Business Alliance to Protect Americans from Chemical Weapons, Washington, D.C., Business Executives for National Security and the Chemical Manufacturers Association, March 1996.

"Molten Metal's CEP Technology to Destroy China's Chemical Agents," *Chemical Engineering*, November 1996.

Moodie, Michael, "Ratifying the Chemical Weapons Convention: Past Time for Action," *Arms Control Today*, February 1996.

Occasional Paper, United States Arms Control and Disarmament Agency, May 18, 1993.

Ondrey, Gerald, "Cementator: Russia Faces CWC Dilemma," *Chemical Engineering*, December 1996.

The Organization for the Prevention of Chemical Weapons News Letter, available at <http://www.ocpw.nl/info.htm>.

Parkinson, Gerald, "Cementator: Chemical Weapons Convention is Ratified, without the U.S. and Russia and Stockpile Destruction is Set to Begin," *Chemical Engineering*, December 1996.

Perry, William J., "Cooperative Threat Reduction, Annual Report to the President and Congress," Department of Defense, Government Printing Office, 1996.

Perry, William J., "Annual Report to the President and the Congress," Department of Defense, Government Printing Office, March 1996.

Perry, William J., "Annual Report to the President and the Congress," Department of Defense, Government Printing Office, February 1995.

Price, Joyce, "Helms sees Senate Ratifying treaty on chemical weapons," *Washington Post*, February 16, 1997.

Program Manager for Chemical Demilitarization, Homepage, available at <http://www.pmcda.apgea.army.mil>.

Proliferation: Threat and Response, Officer of the Secretary of Defense, Government Printing Office, April 1996.

Proliferation of Weapons of Mass Destruction: Assessing the Risk. Office of Technology Assessment, August 1993:17.

Public Law 99-145, November 1985.

"Ratification and Adherence to the Chemical Weapons Convention," United States Arms Control and Disarmament Agency, October 1993.

"Ratifying the Chemical Weapons Convention," *The Center for Strategic and International Studies*, Vol XVI, No 4, Washington D.C., Center for Strategic and International Studies, 1994.

Retech, a Division of M4 Environmental Technologies Homepage, available at <http://www.pacific.net/~retech/>.

Robbins, Carla Anne, "Chemical-Weapons Treaty Shapes Up as Messy Battle," *Wall Street Journal*, February 14, 1997.

"Russia Update," available from <http://www.stimson.org/pub/stimson/cwc/rusadv.htm>.

Schneider, Barry R., Weapons of Mass Destruction: Proliferation Issues, AY 1997, Air University, Maxwell AFB, August 1996.

Schneider, Barry R., *Radical Responses to Radical Regimes: Evaluating Preemptive Counter-Proliferation*, McNair Paper 41, National Defense University, Government Printing Office, May 1995.

Signatures and Ratifications of the CWC, available from <http://www.stimson.org/pub/sign.htm>.

Smithson, Amy E., and Boulden, Laurie H., "Chemical Weapons: Neglected Menace," *Issues in Science and Technology*, Vol XII, No 3, Spring 1996.

Spanier, John and Wedzel, Robert L., *Games Nations Play*, Washington D.C., Congressional Quarterly Press, 1996.

Stanley, Agnes, "CWC Moves on, Without the U.S. as Liability Suits Unfold," *Chemical and Engineering News*, October 1996.

“Tooele,” available from <http://www.pmc.d.apgea.army.mil/csdp>.

“Treaty isn’t perfect, but it does mean safer world,” *USA Today*, Editorial, February 11, 1997.

Turbiville, Graham H., Jr., “Weapons Proliferation and Organized Crime,” *Airpower Journal*, Special Edition 1996.

U.S. Army’s Alternate Demilitarization Technology Report for Congress, Program Manager for Chemical Demilitarization, Department of the Army, Aberdeen Proving Ground, MD, April 1994.

U.S. Army Program Manager for Chemical Demilitarization Alternative Technology Program Evaluation Report (Draft),” Available from <http://www-pmc.d.apgea.army.mil/altech/news6.html>.

Yost, Mark, “Don’t Forget About Iran,” *The Wall Street Journal*, September 23, 1996.